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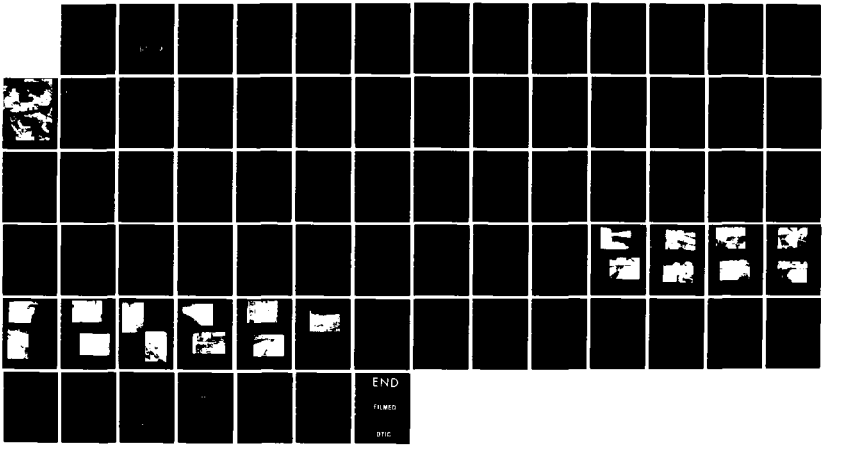
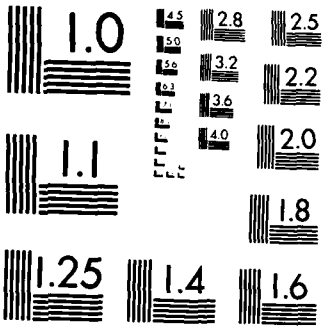




CONNECTICUT RIVER BASIN

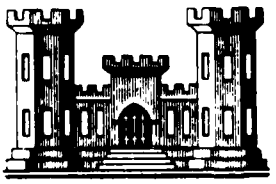
CLAREMONT, NEW HAMPSHIRE

COY DAM

NH 00140

NHWRB NO. 47.10

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

NOVEMBER 1978

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Claremont New Hampshire
Sugar River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a 314 ft. long, 44 ft. high concrete gravity damm. The visual inspection did not disclose any findings that indicate an immediate unsafe condition. The general condition of the dam is poor. The stability of the dam should further be evaluated. There are various recommnedations which should be implemented by the owner.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

JAN 15 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Coy Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Coy Paper Company, Claremont, New Hampshire 03743, ATTN: Mr. Hans U. Scharin, President.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

COY DAM

NH 00140

NHWRB NO. 47.10

CONNECTICUT RIVER BASIN
CLAREMONT, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT

Identification No.: 00140

Name of Dam: Coy Dam

Town: Claremont

County and State: Sullivan, New Hampshire

Stream: Sugar River

Date of Inspection: August 31, 1978

Coy Dam is a 314 foot long, 44 foot high concrete gravity dam. Engineering data available consisted of a set of plans dated 1922 showing plan, elevation and details as well as a set of construction specifications were available for this investigation. No construction data or design calculations were available.

The visual examination did not disclose any findings that indicate an immediate unsafe condition. The general condition of the dam, however, is poor. The inspection revealed a general deteriorated condition of the concrete spillway with evidence of seepage in its lower sections, a deteriorated condition of the concrete walls of both the process water and power generation intake structures with evidence of seepage at the downstream face of the process intake structure, silt deposits within 2 feet of the spillway crest elevation and the inability to drain the reservoir.

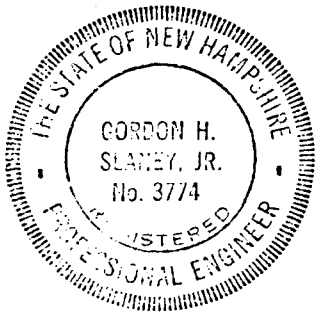
The deteriorated concrete spillway, along with evidence of seepage in its lower section and silt deposits on the upstream face, indicate conditions which could cause a potentially unstable condition. The stability of this dam should therefore be further evaluated.

Coy Dam's spillway will not pass the required test flood. The dam's spillway capacity is approximately 34 percent of the test flood and consequently, the dam would be overtopped under the test flood condition. Review of hydraulic data also indicated that the flows necessary to create substantial depths over the spillway section, adding to the potential for an unstable condition, could be expected to occur on an annual basis.

It is recommended that the owner engage a qualified engineer to investigate further the structural stability of the dam, to design for the repair of the spillway section and intake structures, to make provisions for draining the reservoir and to further evaluate the potential for overtopping and the inadequacy of the spillway.

It is also recommended that the owner remove the flashboards from the spillway section of the dam until a more detailed investigation is made to determine the maximum safe height for the water elevation behind the dam. Further, the owner should set up a program of surveilance of the dam such that during periods of rainfall or snowmelt the depth of flow over the dam's spillway is observed and appropriate warnings be given to individuals downstream of the dam should water levels over the spillway approach 2 feet or more.

The recommendations and remedial measures are described in Section 7 and should, with the exception of removing flashboards and establishing a surveilance program, both of which should be done immediately, be addressed within one year after receipt of this Phase I - Inspection Report by the owner.



Gordon H. Slaney, Jr.

Gordon H. Slaney, Jr., P.E.
Project Engineer

Howard, Needles, Tammen & Bergendoff
Boston, Massachusetts

This Phase I Inspection Report on Coy Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Richard F. Doherty

RICHARD F. DOHERTY, MEMBER
Water Control Branch
Engineering Division

Joseph A. Mc Elroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

[illegible]
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observation of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there by any chance that unsafe conditions be detected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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APPENDIXES

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedure

No written operational procedures were disclosed for the dam. The normal operational procedure for this dam is the utilization of river water for power production and process water. The process water intake structure, located to the right of the spillway, is normally operated with the two main gates closed and the two small high-level gates open for water intake. The intake structure located to the left of the spillway is used for power production. Both main gates feeding the 8 foot diameter penstocks are usually in the open position. This intake structure is occasionally used for process water as well as power production. During most months of the year, river flow is sufficient to produce the required head for power production and no modifications to the spillway are necessary. During the summer months, however, flashboards, approximately 2 feet in height, are added to the spillway crest creating additional storage and available head.

4.2 Maintenance of Dam

Maintenance of this dam consists of occasional concrete patch work. No other maintenance operations were disclosed. The owner has recently indicated his desire to raise the spillway elevation and at the same time provide for resurfacing the spillway section of the dam.

4.3 Maintenance of Operating Facilities

Maintenance of the operating facilities involves racking the bar screens at the power generating and process water intake structures on an as needed basis.

4.4 Description of Warning Systems

There are no warning systems in effect at this facility.

4.5 Evaluation

The current operation and maintenance procedures for Coy Dam are inadequate to insure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written operation and maintenance procedure as well as establishing a warning system to follow in event of flood flow conditions or imminent dam failure.

(b) Deteriorated concrete of the appurtenant structures.

(c) Seepage in the area where the process water penstock leaves the intake structure.

(d) Silt deposits within 2 feet of the spillway crest elevation.

(e) The inability to drain the reservoir.

(f) Inoperable gate at the process water intake structure.

leading to the paper mill's power generators just downstream from the dam. A general view of the power generating intake structure is shown in Photos 3 and 6. The concrete of most portions of the structure is poor as shown on Photos 9 and 16. Spalling of concrete is evident throughout and reinforcing steel is evident on the right wall. Some cosmetic work has been done to the concrete, with some concrete stairs being recently reconstructed. The two main gates and the two high level service gates were reported to be operational. As all gates were below water, they were not inspected. The bar screen is very rusty and scaley. Hand rails in the area of the power generating intake structure are fair to poor and insufficient in number. The 8 foot diameter penstock which feeds the power generating equipment is very rusty. Inspection revealed two leaks about 3 feet downstream of the concrete wall where the penstock leaves the intake structure.

Visual inspection of the spillway discharge channel showed it to consist mostly of rock which appears to be in good condition.

d. Reservoir Area. The reservoir slopes immediately upstream are generally covered with trees and brush. There is one house located immediately to the right of the right abutment of the dam which appears to be in the flood plain. The reservoir area, which is relatively small, has some swampy type growth just upstream of the dam. Siltation on the reservoir appears to be within two feet of the spillway crest elevation.

e. Downstream Channel. The downstream channel has a rock bottom and appears to be in good condition. A 70 foot reach, approximately 140 feet wide, downstream of the spillway, leads to a roadway bridge with a waterway opening width of about 136 feet. Below the bridge the channel passes between two buildings, both abutting the river channel. Crossing the river channel between the two buildings is a pedestrian walkway. Beyond the buildings, the channel is lined on both sides with trees.

3.2 Evaluation

Visual examination indicates no immediate safety problem; however, the condition of the dam is poor and should be further investigated and evaluated. The inspection revealed the following:

(a) Deteriorated concrete spillway with evidence of seepage in the lower portion.

The concrete retaining walls, forming the remainder of the dam either side of the spillway section, are in fair condition with some spalling and cracking noted.

c. Appurtenant Structures. Considering the gravity concrete spillway to be a major portion of the dam, the appurtenant structures consist of process water intake structure, a power generation intake structure and a spillway discharge channel. The left wall of the process intake structure and the right wall of the power intake structure form the right and left training wall, respectively, of the spillway discharge channel. It should be noted that the facilities described below are for power production and process water purposes and cannot be considered entirely as outlet works as they would have to be closed during storm flows, and they cannot lower the river to its riverbed elevation.

Process Water Intake Structure

The process water intake structure is constructed of reinforced concrete and has four wooden mechanically operated gates, a steel bar screen and an 8 foot diameter steel penstock leading to the paper mill just downstream of the dam. A general view and location of the process water intake structure is shown in Photo 2. The concrete of all portions of the structure is poor as shown on Photos 11 and 12. Spalling of concrete is evident throughout, and reinforcing steel is visible in some locations. Of the two main gates for the penstock intake, only the left gate is operational. The two smaller high-level service gates are operational. The stem on the inoperable gate is broken and rotted. All gates, themselves, were below water and therefore not inspected. The bar screen, consisting of steel rods spaced about 1 inch on centers, are very rusty, scaley and have vegetation growing in them. Hand rails in the area of the process water intake structure are in fair condition but insufficient in number. The 8 foot diameter penstock which feeds process water to the mill building is very rusty on the outside but the inside has been relined with gunite. No leaks were visible and the alignment and joints appeared to be in good condition. Just below the penstock, in the area where the penstock passes through the intake structure wall, inspection revealed some apparent seepage through the training wall at its juncture with the channel floor.

Power Generation Intake Structure

The power generation intake structure is constructed of reinforced concrete and has four wooden mechanically operated gates, a steel bar screen and an 8 foot diameter penstock

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of the Coy Paper Company Dam was made on August 31, 1978. The inspection team consisted of personnel from Howard, Needles, Tammen & Bergendoff and Geotechnical Engineers, Inc. A representative of the Coy Paper Company was also present during portions of the inspection. Inspection checklists, completed during the visual inspection, are included in Appendix A. At the time of the inspection, the water level was approximately 15 inches above the permanent spillway elevation, being approximately 11 inches below the flashboard elevation. The upstream face of the dam could only be inspected above this level.

b. Dam. Coy Dam consists of a concrete gravity spillway section with concrete gravity retaining walls forming the right and left sections of the dam. Visual inspection of the dam did not disclose any findings indicating an immediate unsafe condition. Inspection of the downstream face of the spillway section, a major portion of the dam structure, indicates that the entire concrete surface is badly deteriorated and in generally poor condition. Scour depths up to and in some areas exceeding one foot were noted on the spillway section (Photo 10). Seepage through the dam's spillway section was also noted in two areas, 15 feet and 28 feet from the right training wall, both about 8 feet above the channel bottom. This seepage appears to be continuous and appears to be located at a construction joint. The spillway section is approximately 20 feet wide at this point. Photo 8 shows the general location of this seepage.

According to available construction specifications, the concrete used for the spillway construction consisted of approximately three bags of cement per cubic yard of concrete. Construction specifications also indicate that a 1 inch cement/sand mortar was used as a bonding material between construction joints. Visual inspection disclosed a silt deposit at the upstream face of the dam to a height approximately 2 feet below the crest of the spillway. Based on the present operational conditions and silt deposits, as above mentioned, it appears that the upstream face of the spillway section may be in tension. The presence of tension cracks in the upstream face of the spillway section could have a direct relationship to the water seepage through the spillway section.

SECTION 2
ENGINEERING DATA

2.1 Design

A set of plans dated 1922 prepared by Stiles F. Kedy, Engineer, showing plan, elevation, typical sections and details along with a set of specifications are available at the State of New Hampshire Water Resources Board. There were no plans available for construction of an earlier dam located at this site, portions of which were added to in the 1922 project.

2.2 Construction

Other than the fact that this dam was constructed by Fiske-Carter Co., Worcester, Massachusetts, no construction records were available for use in evaluating this dam.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. The Coy Paper Co. Dam was designed by Stiles F. Kedy, Engineer. Other than the plans and specifications described above, no additional engineering data was found to be available.

b. Adequacy. Available engineering data and drawings are considered adequate for a Phase I investigation.

c. Validity. The field investigation indicated that the external features of the dam substantially agree with those shown on the available plans.

(2) Length - 314 feet, overall.

(3) Height - 44 feet (maximum).

(4) Top Width - 2.5 to 6.0.

(5) Side Slopes - US = Vert.; DS = variable.

(6) Zoning - unknown.

(7) Impervious core - N/A.

(8) Cutoff -

(9) Grout Curtain - None.

(10) Other - None.

h. Diversion and Regulating Tunnel

See Section j below.

i. Spillway

(1) Type - concrete ogee.

(2) Length of Weir - 144.0 Feet

(3) Crest Elevation - 350.4.

(4) Gates - None.

(5) U/S Channel - None.

(6) Downstream Channel. A 70 foot reach, approximately 140 feet wide downstream of the spillway leads to a roadway bridge with a waterway opening width of about 136 feet. Below the bridge the channel passes between two buildings, both abutting the river channel. Crossing the river channel between the two buildings is a pedestrian walkway. Beyond the buildings the channel is lined on both sides with trees.

j. Regulating Outlets. The regulating outlets consist of two 8 foot diameter penstocks which are used for process water and power production. There are no by-passes to the process and power generating equipment and therefore water must pass through these units to lower the river to the level of the intake structures (elevation 338.0). There are no provisions for dewatering to the river bed elevation of 320.5.

(2) Maximum tailwater - 348.8 (1936 flood).

(3) Upstream portal invert diversion tunnel -

(4) Recreation pool - N/A.

(5) Full flood control pool - N/A.

(6) Spillway crest (permanent spillway) - 350.4.

(7) Design surcharge - unknown.

(8) Top Dam - 358.4.

(9) Test Flood Surcharge - 364.29.

d. Reservoir (miles)

(1) Length of Maximum Pool

(2) Length of Recreational Pool - N/A.

(3) Length of Flood Control Pool - N/A.

e. Storage (Acre-Feet)

(1) Recreation Pool - N/A.

(2) Flood Control Pool - N/A.

(3) Spillway Crest Pool - 850.

(4) Top of Dam - 1,350.

f. Reservoir Surface (Areas)

(1) Recreation Pool - N/A.

(2) Flood Control Pool - N/A.

(3) Spillway Crest - 62.5.

(4) Test Flood Pool - 62.5

(5) Top Dam - 62.5

g. Dam

(1) Type - concrete gravity dam.

1.3 Pertinent Data

a. Drainage Area. The drainage area above Coy Dam consists of approximately 270 square miles of rolling wooded terrain. Two major highly developed Towns, Claremont and Newport are located within the basin. The upper reach of the basin is formed by Sunapee Lake.

As this is a run of the river type dam, the reservoir area itself is relatively small in surface area. There are evidences of vegetation in the reservoir immediately upstream of the dam. As the Sugar River passes through the Town of Claremont, just east of the dam, the river is lined with businesses and other development.

The watershed supporting the Sugar River is forested, rolling terrain except in the Claremont and Newport areas. The watershed has quite a number of paved roads and residential and industrial development. Topographic elevation in the watershed ranges from about 2,740 to 320 feet MSL.

b. Discharge at Dam Site

(1) The outlet works for Coy Dam consist of two 8 foot diameter penstocks which are used for process water and power production. There are no by-passes to the process and power generating equipment and therefore water must pass through these units to lower the river to the level of the intake structures. There are no provisions for dewatering to the river bed elevation.

(2) The maximum known discharge at this dam site is 14,000 cfs which occurred in 1936.

(3) The spillway capacity with a water surface at the top of the dam is approximately 12,350 cfs at an elevation of 358.4.

(4) The spillway capacity with the water surface at the test flood elevation is approximately 29,070 cfs at an elevation of approximately 364.29.

(5) The total project discharge at the test flood elevation of 364.29 is estimated to be 37,560 cfs.

c. Elevation (feet above MSL)

(1) Streambed at centerline of dam - 320.5.

e. Ownership. This dam is owned by the Coy Paper Company, Claremont, New Hampshire 03743.

f. Operator. This dam is maintained and operated by the Coy Paper Company, Claremont, New Hampshire. Mr. Hans U. Scharin is the company's President; Mr. F. Rosinski is the Plant Manager, Telephone No. (603)542-4673.

g. Purpose of Dam. This dam is used for power generation and as a source of process water, both for the operation of Coy Paper Company.

h. Design and Construction History. The drawings and specifications for this dam were prepared by Stiles F. Kedy, Engineer, and are dated 1922. Construction was started and completed in that general time period. (Original dam constructed of wooden timbers was replaced at this time except for some minor portions of the appurtenant structures which were incorporated into the 1922 dam). The drawings and the specifications for this dam are available at the New Hampshire Water Resources Board. No in-depth design or construction data were disclosed for this dam.

i. Normal Operating Procedure. No written operational procedures were disclosed. The normal operational procedure for this dam is the utilization of river water for power production and process water. The process water intake structure, located to the right of the spillway, is normally operated with the two main gates closed and the two small high-level gates open for water intake. The intake structure located to the left of the spillway is used for power production. Both main gates feeding the 8 foot diameter penstock are usually in the open position. This intake structure is sometimes used for process water as well as power production. During most months of the year, river flow is sufficient to produce the required head for power production and no modifications to the spillway are necessary. During the summer months, however, flashboards, approximately 2 feet in height, are added to the spillway crest creating additional storage and available head.

There are no by-passes available to the power and process equipment, therefore, in the event of high flows or flooding conditions, all gates are closed and all flows must pass through the spillway section. The dam has no means of lowering the water level other than through the power and process water intake structures. The reservoir level, therefore, cannot be lowered to river bed elevation.

spillway section located in about the center of the dam. The top of the spillway is approximately 6 feet wide. The upstream face of the spillway section is vertical for its full height. The downstream face has a batter of about 1.0 foot horizontal to 1.67 feet vertical with a curved section at the toe transitioning into the river bed. The concrete spillway was placed over a rock foundation and is anchored into the rock by 1½ inch diameter steel rods at 18 inch spacing. The remaining sections of the dam consist of concrete gravity retaining walls on either side of the spillway section. These walls vary in height from about 15 feet at the spillway section to 8 feet at the right and left abutments. The top of these walls are 2.5 feet wide. The upstream faces are vertical and the downstream face has a variable slope.

The appurtenant structures consist of a process water intake structure and a power generation intake structure. The process water intake is located to the right of the spillway, the left wall of the structure forming the right training wall of the spillway channel. The structure contains four wooden gates, two being large low-level gates and two being smaller high-level gates. Downstream of the gates is a bar screen and an 8 foot diameter penstock leading to the paper mill just downstream of the dam.

The power generating intake structure is located to the left of the spillway, the right wall of the structure forming the left training wall of the spillway channel. Gates, bar screens and penstock located at the power generation intake are similar to those of the process water intake structure.

Other than the process water and power generating intake structures there is no other facility for outletting water from behind the dam below the spillway elevation.

Figure 1, located in Appendix B, shows the plan of the dam, spillway and outlet works. Photographs of each structure are shown in Appendix C.

c. Size Classification. Intermediate (hydraulic height - 44 feet high, storage - 1,350 acre-feet) based on storage ($\geq$1,000 to 50,000 acre-feet) as given in recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. The dam's potential for damage rates is as a significant hazard classification. A major breach could result in damage to both main buildings of the Coy Paper Company, two small business buildings, one trailer and a Central Vermont Sub-Station as well as a bridge and walkway immediately downstream of the dam. With this potential for damage, it could be expected that a few lives would be lost.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
COY DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Howard, Needles, Tammen & Bergendoff has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Howard, Needles, Tammen & Bergendoff under a letter of July 12, 1978 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0356 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

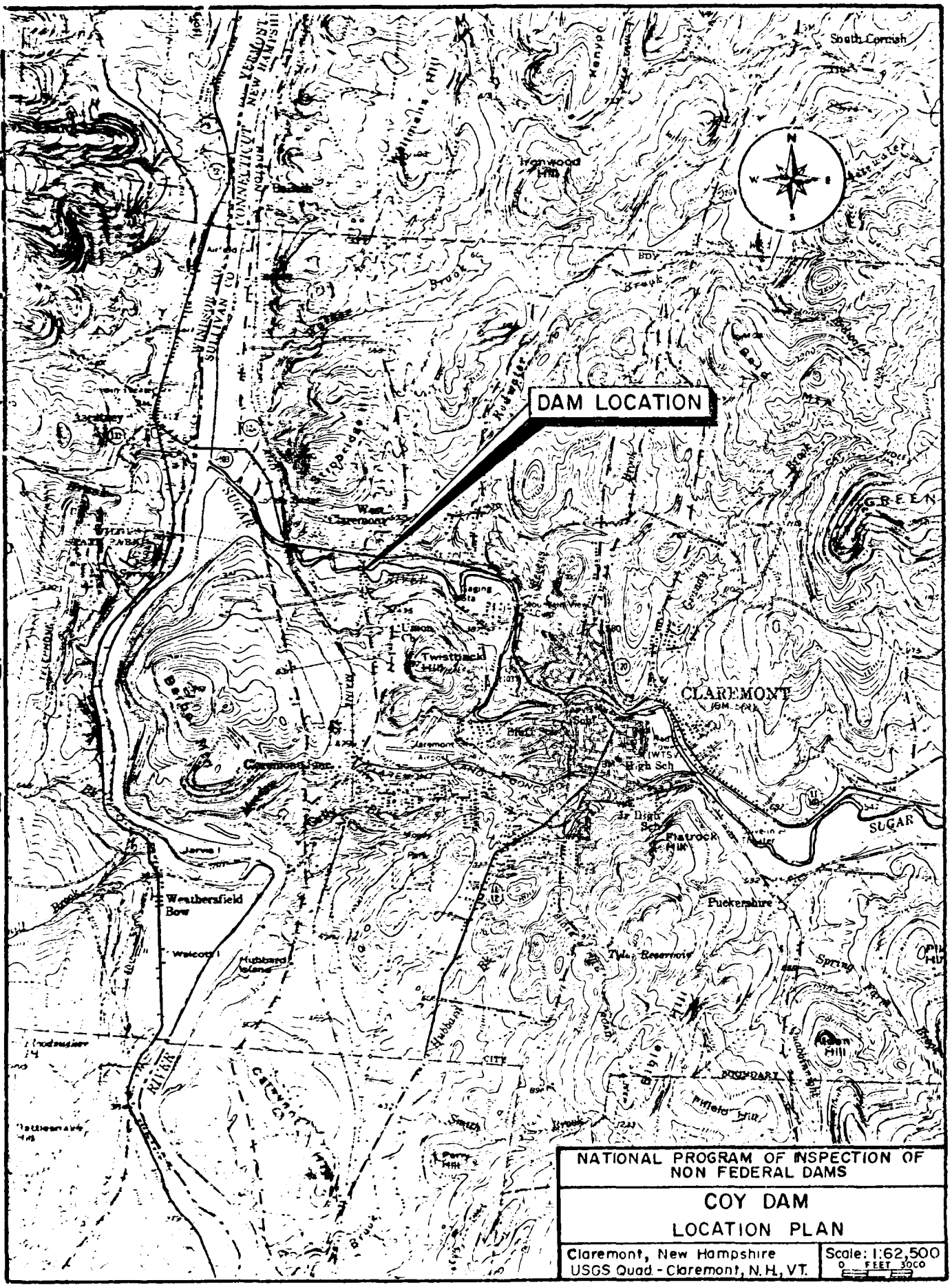
(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Coy Dam is located on the Sugar River, approximately 1.5 miles upstream from its confluence with the Connecticut River, in the Town of Claremont, New Hampshire. The dam is shown in U.S.G.S. Quadrangle, Claremont, New Hampshire-Vermont, with coordinates approximately N43°23'30", W72°22'40", Sullivan County, New Hampshire. Coy Dam's location is shown on the Location Map immediately preceding this page.

b. Description of Dam and Appurtenances. Coy Dam is a concrete gravity dam having a maximum height of about 44 feet and an overall length of about 314 feet. The major portion of the dam consists of a 144 foot long, 36 foot high concrete



NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

COY DAM

LOCATION PLAN

Claremont, New Hampshire
USGS Quad - Claremont, N.H., VT.

Scale: 1:62,500
0 FEET 3000

COY DAM - Overview Looking Upstream

SECTION 5
HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features

a. General. Coy Dam is a concrete gravity dam approximately 44 feet high and 314 feet long. The appurtenant structures consist of a spillway structure, a process water intake structure and a power generating intake structure. The spillway, located in approximately the center of the dam and of the Sugar River is constructed of concrete and has a maximum height of about 36 feet. The spillway has a waterway opening approximately 144 feet long and 8 feet high from the spillway crest to the top of the dam. Other than the process water and power generating intake structures there is no provision for lowering the Sugar River below the spillway crest elevation. Coy Dam is classified as being intermediate in size having a maximum height of 44 feet and a maximum storage of 1,350 acre-feet.

b. Design Data. No hydrologic or hydraulic design data were disclosed for Coy Dam.

c. Experience Data. Maximum flows of 14,000 cfs and 13,000 cfs were recorded in March 1936 and September 1938, respectively. The September 1938 storm produced a water depth of 8.71 feet over the spillway. As the elevation of the crest of the dam is 8.0 feet above the spillway crest, the 1938 storm overtopped the dam crest by 0.71 feet. Tailwater elevation during the 1936 storm was approximately 28 feet deep or within 2 feet of the spillway elevation. Also, during the 1927 flood, water levels came to within 2 inches of the top of the dam. No flows were recorded for the 1927 storm.

d. Visual Observations. No evidence of damage to any portion of the project from overtopping was visible at the time of the inspection.

e. Overtopping Potential. As no detailed design and operational information are available, hydrologic evaluation was performed using dam information gathered by field inspection, watershed size and an estimated test flood equal to one-half the Probable Maximum Flood (PMF) as determined by guide curves issued by the Corps of Engineers. Based on a drainage area of 270.0 square miles, it was estimated that the test flood inflow at Coy Dam would be 37,800 cfs. Following the guidance for Estimating Effect of Surcharge Storage on Maximum Probable Discharge results in a test flood discharge of 37,560

cfs. As the maximum spillway capacity at the top of the dam is only 12,710 cfs (approximately 34 percent of the test flood discharge flow), the test flood will result in the dam being overtopped by approximately 6.0 feet.

f. Dam Failure Analysis. The impact of failure of the dam at maximum pool was assessed using the "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to the Connecticut River.

Failure of Coy Dam at maximum pool would probably result in an increase in downstream channel depth of approximately 14 feet between the dam and the Connecticut River approximately 7,000 feet downstream. Historical data indicates, however, that a downstream channel depth of approximately 28 feet could be expected should flows be great enough to create the maximum pool condition. Either an increase in water depth of 14 feet or a downstream depth of 28 feet would probably result in damage to both main buildings of the Coy Paper Company, a small shed on the property of Coy Paper Company as well as possible damage to the roadway bridge immediately downstream of the dam. Damage to the elevated walkway between the two main buildings of the Coy Paper Company is also a distinct possibility. Further downstream there are two businesses, one trailer and a Central Vermont Sub-Station, not shown on the U.S.G.S. map, that could possibly be affected by dam failure. Beyond this area, there appears to be no further potential for damage to the Connecticut River. It should be noted that due to the relatively small volume of impounded water behind Coy Dam that actual test flood flows passing the dam, assuming the dam did not fail, would have the potential of creating the same, if not greater, damaging effects on the downstream channel area.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The visual inspection did not disclose any immediate stability problems with the dam. However, inspection of the spillway section (a major portion of the dam) revealed generally poor conditions, including deteriorated concrete and seepage, which should be further investigated to determine appropriate corrective measures. Failure of the spillway section would effectively create a failure of the dam itself.

Visual inspection also revealed silt deposits to within 2 feet of the spillway crest. The presence of silt behind the spillway creates additional horizontal forces on the dam.

b. Design and Construction Data. Design drawings and construction specifications exist and indicate that the spillway section of the dam was constructed with concrete containing approximately three bags of cement per cubic yard of concrete and that a one-inch cement/sand mortar was used as a bonding material between construction joints. Under present operating conditions, it appears that the upstream face of the spillway section is in tension. The presence of tension cracks in the upstream face of the spillway section could have a direct relationship to the water seepage through the spillway section and could lead to the potential for an unstable condition.

c. Operating Records. No operating records were made available.

d. Post-Construction Changes. Since construction of the dam in 1922 (only small portions of the 1908 dam being retained) only minor repair of walls and stairways at the intake structures has taken place.

e. Seismic Stability. The dam is located in Seismic Zone 2, and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual inspection of Coy Dam did not disclose any findings that indicate an immediate unsafe condition. The observed condition of the dam, however, is poor. The inspection revealed the following:

(1) A general deteriorated condition of the concrete spillway with evidence of seepage in its lower sections.

(2) A general deteriorated condition of the concrete walls of both the process water intake structure and the power generating intake structure.

(3) Seepage in the area where the process water intake penstock leaves the intake structure (forming the right training wall and dam abutment of the spillway section).

(4) Silt deposits within 2 feet of the spillway crest elevation.

(5) The inability to drain the reservoir to river bed elevation.

(6) An inoperable gate at the process water intake structure.

The deteriorated concrete spillway, along with evidence of seepage in its lower section and silt deposits on the upstream face indicate conditions which could cause a potentially unstable condition. The stability of the dam should therefore be further evaluated.

The hydraulic analysis indicates that the dam cannot pass the required test flood, being able to pass only 34 percent of the test flood. Review of hydraulic data also indicates that the flows necessary to create substantial depths over the spillway could be expected to occur on an annual basis.

b. Adequacy of Information. The information made available by the New Hampshire Water Resources Board was adequate for a Phase I level of investigation.

c. Urgency. This dam is in poor condition and the recommendations and remedial measures described in Sections 7.2 and 7.3 should, unless otherwise specified, be accomplished within one year after receipt of this Phase I Inspection Report by the owner. Remedial measures described in Sections 7.3a and 7.3b should be addressed immediately.

d. Need for Additional Investigation. The findings of the visual investigation indicate that the owner should engage a qualified engineer to implement the recommendations of Section 7.2.

7.2 Recommendations

It is recommended that the owner retain the services of a qualified engineer to:

(a) Investigate further the structural stability of the concrete spillway section of the dam.

(b) Design remedial measures for the badly scoured and deteriorated concrete spillway including the elimination of seepage and silt deposits.

(c) Design remedial measures for the deteriorated concrete of the process water and power generating intake structures, particularly at the process water intake structure where evidence of seepage was noted.

(d) Provide measures for draining the reservoir.

(e) Evaluate further the potential for overtopping and the inadequacy of the spillway.

7.3 Remedial Measures

(a) Remove the flashboards from the spillway section of the dam until a more detailed investigation is made to determine the maximum safe height for the water elevation behind the dam.

(b) Set up a program for surveillance of the dam such that during periods of rainfall or snowmelt, the depth of flow over the dam spillway is observed and appropriate warnings be given to individuals downstream of the dam should water levels the spillway approach 2 feet or more.

(c) Develop a written operational procedure to follow in the event of flood flow conditions or imminent dam failure.

(d) The technical inspection program should be continued on a bi-annual basis.

7.4 Alternatives

There are no practical alternatives to the recommendations made in Section 7.2 and 7.3 except that on an interim basis the owner may consider operating the reservoir at a lower level so as to increase the stability of the dam.

APPENDIX A

VISUAL CHECKLIST WITH COMMENTS

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Coy Paper Company Dam
Claremont, New Hampshire

DATE August 31, 1978

TIME 10:00 A.M.

WEATHER Cloudy, Occasional Drizzle

W.S. ELEV. 351.6 U.S. 320.5 DN.S

PARTY:

1. Gordon Slaney, HNTB
2. Stan Mazur, HNTB
3. Dan LaGatta, HNTB
4.
5.
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Geotechnical	Dan LaGatta	
2.	Concrete Dam, Spillway	Stan Mazur	
3.	Outlet Works/Downstream Channel	Gordon Slaney	
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT Coy Dam - Claremont DATE August 31, 1978

PROJECT FEATURE Concrete Dam NAME S. Mazur

DISCIPLINE Structural/Hydraulic Engineers NAME G. Slaney

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	358.4
Current Pool Elevation	351.6
Maximum Impoundment to Date	359.1 (1936)
Surface Cracks	
Pavement Condition	No pavement.
Movement or Settlement of Crest	None visible.
Lateral Movement	None visible.
Vertical Alignment	No misalignment observed.
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	Training walls of spillway section badly deteriorated.
Indications of Movement of Structural Items on Slopes	None observed.
Trespassing on Slopes	None observed.
Sloughing or Erosion of Slopes or Abutments	None observed.
Rock Slope Protection - Riprap Failures	
Unusual Movement or Cracking at or near Toes	See spillway section.
Unusual Embankment or Downstream Seepage	See spillway section
Piping or Boils	None observed.
Foundation Drainage Features	
Toe Drains	
Instrumentation System	None.

PERIODIC INSPECTION CHECK LIST

PROJECT Coy Dam, Claremont DATE August 31, 1978

PROJECT FEATURE Intake Channel/Structure NAME S. Mazur

DISCIPLINE Structural/Hydraulic Engineers NAME G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	None.
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	Poor.
Stop Logs and Slots	Debris bar screen at process water intake and power generating intake structures both very rusty and in poor condition.

PERIODIC INSPECTION CHECK LIST

PROJECT Coy Dam - Claremont — DATE August 31, 1978

PROJECT FEATURE Control Tower — NAME S. Mazur

DISCIPLINE Structural/Hydraulic Engineers — NAME G. Slaney

AREA EVALUATED	CONDITION	
OUTLET WORKS - CONTROL TOWER	Control Towers and Inlet Structure are one and the same.	
a. Concrete and Structural	Process Intake	Power Intake
General Condition	Poor	Poor
Condition of Joints	Poor	Poor
Spalling	Throughout	Throughout
Visible Reinforcing	Some observed	Some Observed
Rusting or Staining of Concrete	Screens heavily rusted	Screens heavily rusted
Any Seepage or Efflorescence	Seepage at downstream face of structure	None observed
Joint Alignment		
Unusual Seepage or Leaks in Gate Chamber	None observed	None observed
Cracks	Throughout	Throughout
Rusting or Corrosion of Steel	Visible steel rusted	Visible Steel Rusted
b. Mechanical and Electrical		
Air Vents		
Float Wells	Of the two main gates, only the left gate is operational. Stem of inoperable gate is broken and rotted.	All gates in fair condition
Crane Hoist		
Elevator		
Hydraulic System		
Service Gates		
Emergency Gates		
Lightning Protection System		
Emergency Power System		
Wiring and Lighting System	Wiring for light runs from mill building	Wiring runs overground from mill building

PERIODIC INSPECTION CHECK LIST

PROJECT Coy Dam - Claremont

DATE August 31, 1978

PROJECT FEATURE Conduits

NAME S. Mazur

DISCIPLINE Structural/Hydraulic Engineers

NAME G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Process water and power generating water is delivered to the mill buildings via 8 foot diameter penstock. The process water penstock is very rusty on the outside but has been relined with gunite. No leaks were visible and the alignment and joints appear to be in good condition. The power generating penstock is very rusty on the outside and two leaks were observed approximately 3 feet downstream from the downstream face of the intake structure.
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Coy Dam - Claremont DATE August 31, 1978

PROJECT FEATURE Outlet Structure/Channel NAME S. Mazur

DISCIPLINE Structural/Hydraulic Engineers NAME G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Both the process water and power generating water discharge downstream after passing through the mill buildings. The outlet structure beyond the power operating equipment consists of concrete walls on river bed rock. Both walls are in poor condition (no foundation remaining). Riprap in the area is good.
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	None.
Condition of Discharge Channel	Good.

PERIODIC INSPECTION CHECK LIST

ROJECT Coy Dam - Claremont DATE August 31, 1978

ROJECT FEATURE Spillway/Discharge Channel NAME S. Mazur

ISCIPLINE Structural/Hydraulic Engineers NAME G. Slaney

AREA EVALUATED	CONDITION
UTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
. Approach Channel	
General Condition	Fair.
Loose Rock Overhanding Channel	None.
Trees Overhanging Channel	None of significance.
Floor of Approach Channel	Silt to within 2 feet of spillway crest elevation.
. Weir and Training Walls	
General Condition of Concrete	Poor.
Rust or Staining	Some staining, particularly at seepage areas.
Spalling	Throughout.
Any Visible Reinforcing	In several areas.
Any Seepage or Efflorescence	Seepage noted in two locations about 8 feet above bottom.
Drain Holes	
. Discharge Channel	
General Channel	Rock river bed appears to be in good condition..
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Channel	
Other Obstructions	Bridge and pedestrian walkway just downstream.

PHOTO NO. 7 - General view of spillway from left abutment.

PHOTO NO. 8 - General view of dam seepage area. Photo take from roadway bridge.

PHOTO NO. 5 - Gravity retaining wall (dam) at right abutment.

PHOTO NO. 6 - General view of spillway from process intake structure.

PHOTO NO. 3 - General view of dam and power intake structure from process intake structure.

PHOTO NO. 4 - General view of dam from left abutment.

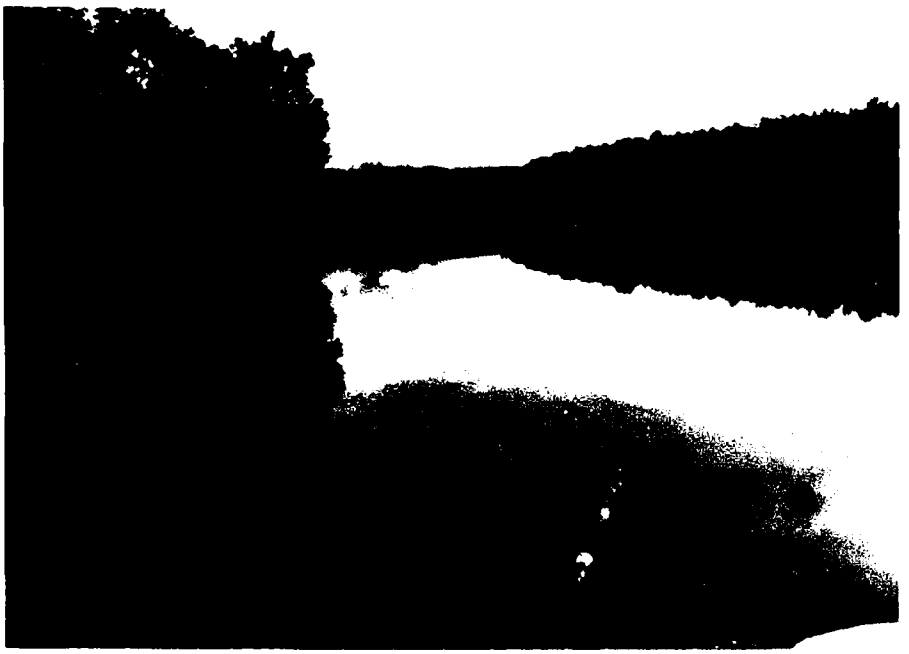


PHOTO NO. 1 - General view of reservoir from power intake structure.

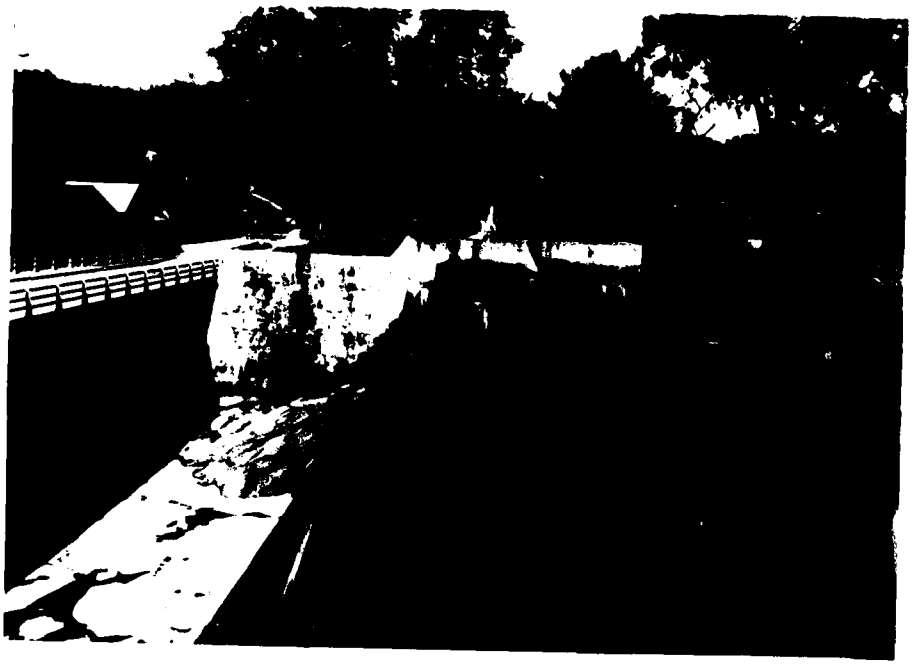


PHOTO NO. 2 - General view of dam and process intake structure from power intake structure.

APPENDIX C

PHOTOGRAPHS

FOR LOCATION OF PHOTOS, SEE FIGURE 1
LOCATED IN APPENDIX B

WATER CONTROL COMMISSION

STATE OF NEW HAMPSHIRE

Concord, New Hampshire

October 13, 1938.

Coy Paper Co.,
Claremont, N. H

RE: Coy Paper Dam. W. C. C. No. 47.10

Gentlemen:

In order that we may determine the magnitude and extent of the flood of September 21-24 just passed, we are requesting the various dam owners in the State to supply us with the following information:

1. Was this dam injured? Ans. No

2. If so, to what extent? Ans.

3. Did all flashboards go out? Ans. Yes

4. What was the maximum height of water over the permanent crest of spillway? Ans. 8'- 8½"

5. At what day and hour did the maximum flood height reach your dam? Ans. About 11:00 PM Wednesday Sept. 21, 1938

6. Any other interesting information regarding the flood or rain fall may be given on the back of this sheet, or attach sheets.

Will you please return this letter with as much information as you can give us as promptly as possible. A self-addressed envelope is attached hereto.

We thank you for your cooperation.

Very truly yours,

Richard S. Holmgren

Richard S. Holmgren
Chief Engineer

CDC:GMB
Enc.

M E M O R A N D U M

DATE: April 10, 1973

FROM: Donald M. Rapoza, Water Resources Engineer

SUBJECT: Inspection of Dam #47.10 - Sugar River, Claremont

TO: Vernon A. Knowlton, Chief Engineer, Water Resources Board

On April 10, 1973, I inspected Dam #47.10, owned by the Coy Paper Co. on the Sugar River in West Claremont.

The bridge downstream of the dam is posted for "passenger cars only", and during my brief inspection period two trucks passed over the structure.

The condition of the structure is deteriorating with time and should be inspected every two years. Concrete on both abutments is spalling from thawing and freezing, and reinforcing steel is exposed in both abutments. There is a very small amount of seepage through the concrete walls at both abutments. A small pool of water was standing at the downstream side of the right abutment. A section of the crest on the O Gee spillway had spalled off. There are four head gates which control the flow of water through two penstocks - two gates for each penstock. Water from the penstock at the right abutment is used for processing and has one gate which is inoperable, (the stem is broken and rotted), and water from the left penstock is used for power. (Both gates operable.)

Because of the large flow, I could not determine if the downstream toe of the spillway and both abutments have any seepage. It is my understanding the bridge downstream of the dam is to be replaced, and there is some thought of using explosives in constructing a new structure. It is my recommendation that no explosives be used at either abutment, due to the condition of the abutments and a good possibility of rupturing the penstocks and/or breaking the seal between the penstocks and the concrete retaining walls. If a pier is required at midspan in the channel, I would recommend any ledge excavation be done by drilling, wedging and barring. The exposed ledge formation is very seamy and if this is indicative of the whole area, the use of explosives could open seams under the spillway and/or break the seal between the spillway and the ledge.

I believe that the rock formation is such that drilling, wedging and barring would be a practical solution to any ledge excavation in view of the risk involved by using explosives.

The Coy Paper Co. should be informed by the Board that the structure is deteriorating, and if left unchecked, the dam would have to be classed as a "dam in disrepair" and be ordered repaired or breached. Presently, it is my opinion that the dam is safe, but as previously stated, it should be inspected every two years. (See three photographs.)

DMR:js

TO: Vernon A. Knowlton, Chief Engineer

FROM: Donald M. Rapoza, Civil Engineer

SUBJECT: Modifications to Coy Paper Company Dam in Claremont (Dam #47.10)

DATE: October 3, 1977

On September 20, 1977 our office received a "Statement of Intent" from Coy Paper Company to reface the downstream face of the spillway and permanently raise the height of the structure by 2.0 ft.

After a review of our file and gaging station data at West Claremont, I do not recommend that the Board approve of the increase in spillway height.

Gaging station data indicates that the 100 year storm would produce a flow of approximately 14,000 cfs. This flow was realized in the storms of March 19, 1936 and September 21, 1938; 14,000 cfs and 13,100 cfs respectively. Information in our files indicate that during the September 1938 storm the flashboards had failed and 8.71 ft. of water was going over the spillway. Plans and sketches shows the spillway 8.0 ft. below the permanent crest.

On September 27, 1977 I met with Mr. Hans V. Scharin, President of Coy Paper Company, and reviewed his proposal. I mentioned the problems associated with reducing the discharge capacity of the structure. Mr. Scharin explained that he has a problem with replacing the flashboards every Spring and by raising the spillway two feet, the replacement costs could be eliminated. I told him that the Board would probably not approve his request without a detailed hydraulic study indicating the stability of the structure with the increased height and the safe passage of the 100 year storm, 14,000 cfs. The site viewing indicates that it would be impractical to raise the abutments.

Mr. Scharin indicated that he would probably review his request after consulting with an engineer.

DMR:njk

October 18, 1977

Mr. Hans V. Scharin, President
Coy Paper Company
Claremont, NH 03743

Dear Mr. Scharin

This is in reply to your letter dated September 16, 1977 requesting approval for the repairs and permanently increasing the height of the existing spillway on your dam located on Sugar River in Claremont (Dam #47.10).

An inspection of the site was conducted on September 27, 1977 and after reviewing the inspection report and historic flow data at your dam; the New Hampshire Water Resources Board will not approve the raising of existing crest 2'-0" with reinforced concrete unless an approved in depth engineering study can show that the structure can safely pass the 100 year flood flows (approximately 14,000 cfs).

The Board will approve the downstream facing of the spillway proving that the existing spillway height is not increased. It may be necessary to remove a few inches of existing concrete on the top of spillway to compensate for the new facing.

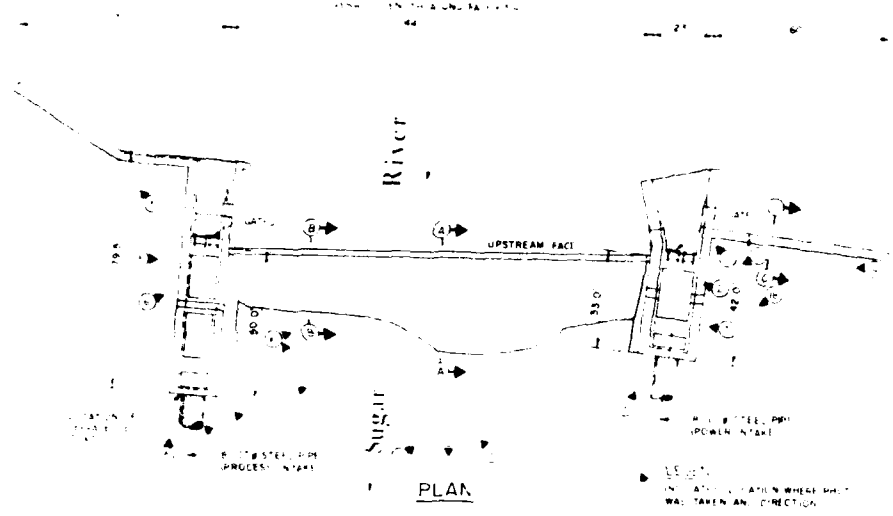
Feel free to call or write if you have any questions.

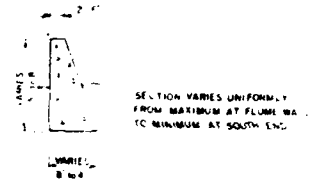
Sincerely yours,

George M. McGee, Sr.
Chairman

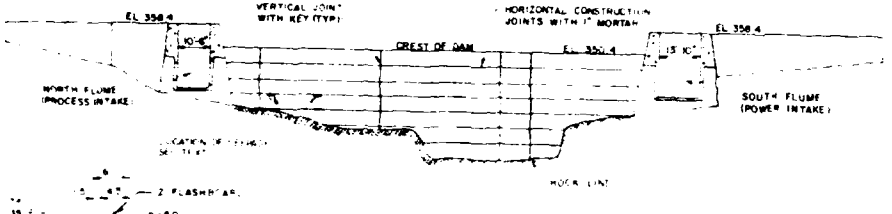
GMMG:DMR:njk

PAST INSPECTION REPORTS

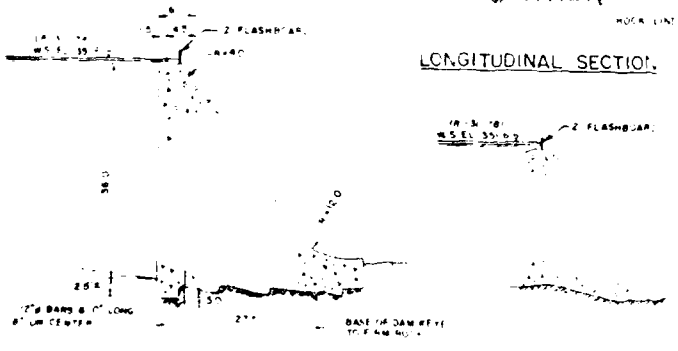




SECTION C-C



LONGITUDINAL SECTION



SECTION A-A

SECTION B-B

NOTES

1. THE ELEVATIONS SHOWN ARE BASED ON MSL AS OBTAINED FROM DATA SHEETS SUPPLIED BY THE NEW HAMPSHIRE WATER RESOURCES BOARD.
2. THE INFORMATION SHOWN ON THIS DRAWING IS BASED ON THE ORIGINAL CONSTRUCTION PLANS AND VISUAL OBSERVATIONS MADE DURING THE FIELD INSPECTION. DIMENSIONS OR MATERIALS INDICATED ON THIS DRAWING WHICH WERE BELOW GRADE OR WATER DURING THE TIME OF INSPECTION WERE NOT VERIFIED.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAM

COY DAM

AVAILABLE ENGINEERING DATA

A set of plans dated 1922 prepared by Stiles F. Kedy, Engineer showing plan, elevation, typical sections and details is available at the New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301.

A set of construction specifications is also available at the New Hampshire Water Resources Board.

APPENDIX B

1. LIST OF DESIGN, CONSTRUCTION AND MAINTENANCE RECORDS
2. PLANS AND DETAILS
3. PAST INSPECTION REPORTS

PERIODIC INSPECTION CHECK LIST

PROJECT _____ DATE _____

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	None.
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

PHOTO NO. 9 - General view of power intake structure. Photo taken from roadway bridge.

PHOTO NO. 10 - Close-up view of spillway surface. Photo taken from downstream channel. Note distance between rule and face of spillway is about 12 inches.

PHOTO NO. 11 - General view of concrete deterioration at process intake structure. Right and front walls are shown.

PHOTO NO. 12 - Close-up of concrete deterioration at process intake structure. Left wall is shown.

PHOTO NO. 13 - Process intake structure, close-up view of left wall.

PHOTO NO. 14 - Process intake structure, seepage area at front wall.

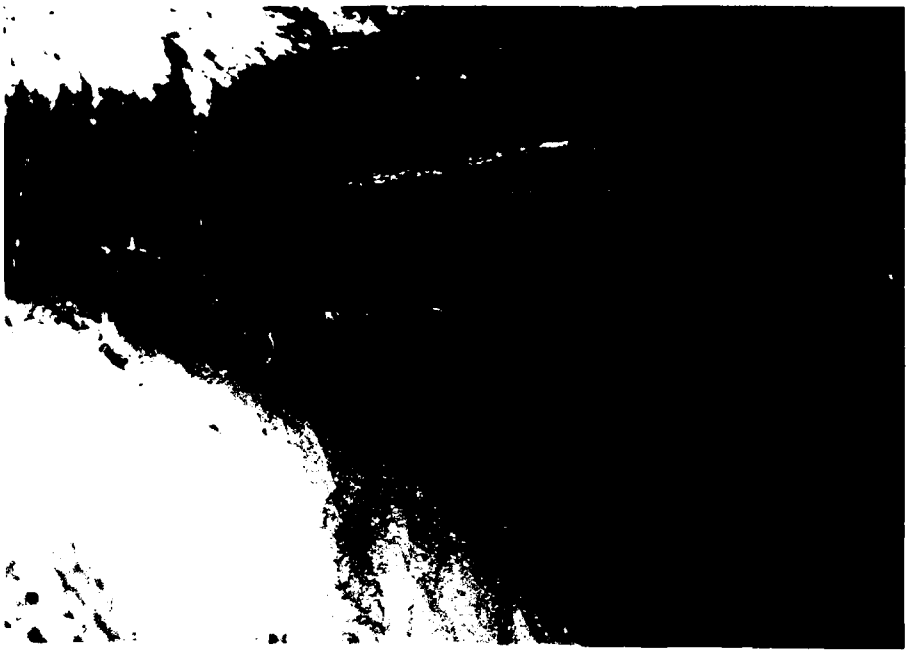


PHOTO NO. 15 - Process intake structure, wall concrete condition detail.

PHOTO NO. 16 - Close-up of concrete deterioration at power intake structure, front wall is shown.

PHOTO NO. 17 - Service gate mechanism at power intake structure, manually operated.

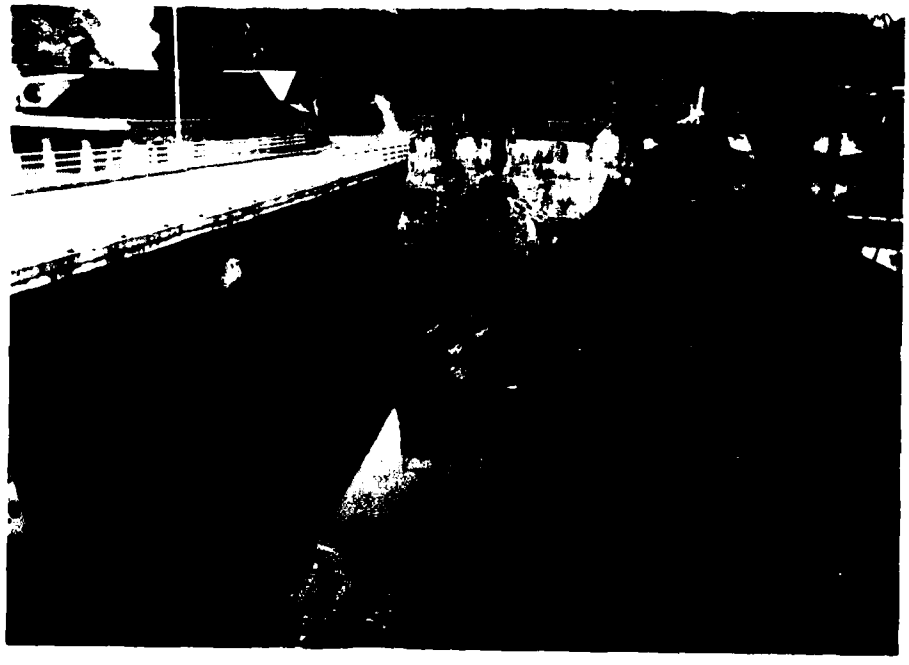


PHOTO NO. 18 - View of spillway outlet channel from power intake structure.

PHOTO NO. 19 - General view of downstream channel.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Made by	HH	Date	10/11/78	Job No.	5628-11-03
Checked by	MPK	Date	11/24/78	Sheet No.	1

For COY DAM - CLAREMONT, N.H.

BASIC DATA:

D.A (Drainage Area) = 270 Square Miles. [Checks OK]
LOCATION: West Claremont, N.H. ZONE = Flat W/ Avg. Slope .1%.*
MAXIMUM DISCHARGE RECORDED = 14,000 CFS (Mar. 19, 1936)
NOTE: Flow regulated by Sunapee Lake 25 Mi. upstream.

DAM CLASSIFICATION:
SIZE Intermediate [Storage = 850 A-F & Height = 44']
HAZARD POTENTIAL: Significant

For dams with an intermediate Size and Significant Hazard potential Classifications a Test Flood equal to the $\frac{1}{2}$ PMF is indicated in The Corps of Engineers Guidelines.

RESERVOIR DATA
NORMAL STORAGE: 850 AF
MAXIMUM STORAGE: 1,350 AF
SURFACE AREA: 62.5 AC. (Estimated)

SPILLWAY DATA (El. 350.4' MSL)
LENGTH = 144 Feet.
HYDRAULIC HEIGHT = 44' (Varies)
STRUCTURAL " = 44' "
TYPE. Concrete Ogee Shape.
Width at Crest: 6 Feet

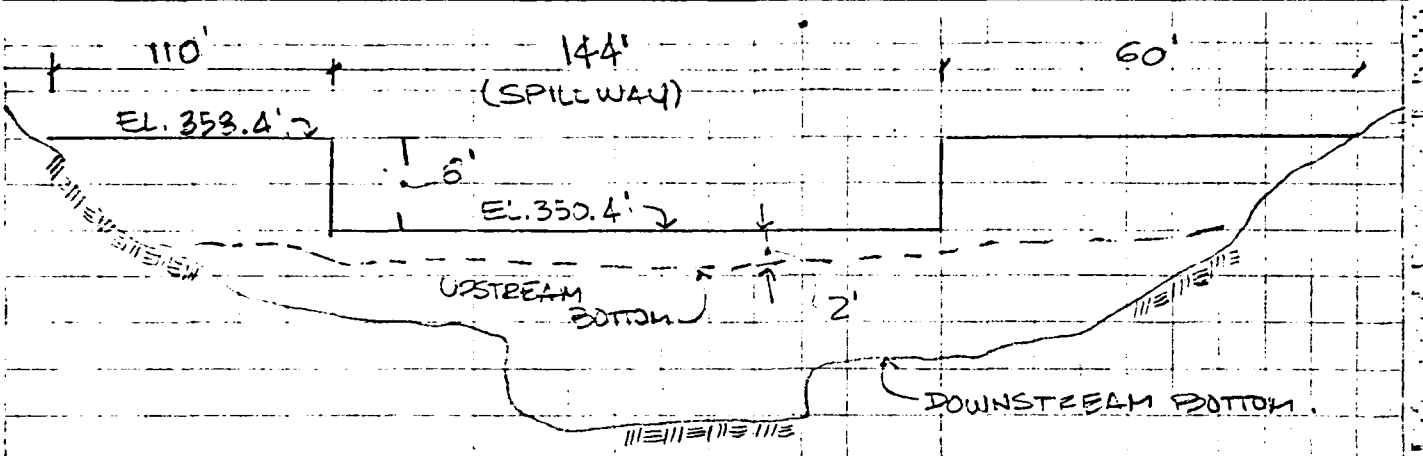
CREST DATA (El. 358.4' M.S.L.)
LENGTH 314 Feet (including spillway)
TYPE Concrete wall.
ELEVATION ABOVE SPILLWAY. 8 Feet.

OUTLET WORKS.
(2) TWO 8'. DIA CONDUIT (Penstocks) FOR GENERATING ELECTRIC POWER. Gate Controlled.

* Avg river slope. The use of flat slope in determining $\frac{1}{2}$ PMF discharge is justifiable due to the effects of upstream controls, including Sunapee Lake.

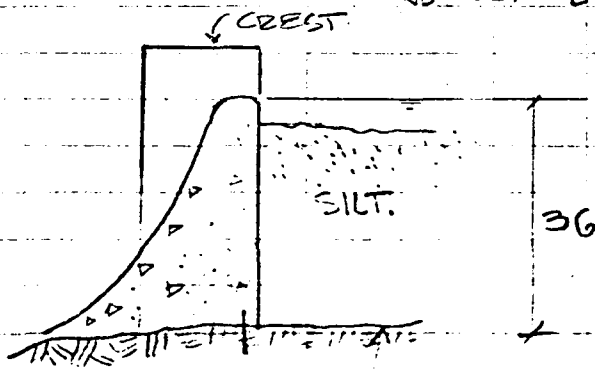
METRIC 4-20M

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by HM	Date 9/11/78	Job No. 5.23-11-03
	Checked by VWH	Date 10/26/78	Sheet No. 2
For COY DAM			



LONGITUDINAL SECTION ALONG UPSTREAM FACE OF DAM

NO SCALE



SECTION OF SPILLWAY

ESTIMATING EFFECT OF SURCHARGE OF P.M.F. DISCHARGE

STEP 1 : Determination of Peak Inflow from guide Curves.

DATA

D.A = 170 Square Miles

ZONE : Flat (Average Slope : 1% ±)

TEST FLOOD = ½ PMF (Significant Hazard & Intermediate Size) using Corps of Engineers Procedures.

EFFECT OF SURCHARGE STORAGE (CONT.)

From guide curves for Flat & Coastal terrain and D.A. = 270 Sq. Mi. The PMF rate : 280 CFS/S.M.

Test Flood $Q_{P_1} = \frac{1}{2}[280\ CFS/S.M. \times 270\ S.M.] = 37,800\ CFS.$

STEP 2 DETERMINE SURCHARGE HEIGHT TO PASS Q_{P_1}.

Note: The Crest of the dam is assumed to act as a Sharp-Crested weir. Accordingly:

$$Q_c = C \times L_c \times H_c^{3/2} \qquad \text{for } H/P < 1.5$$

Where:

$C = \left(3.27 + 0.4\frac{H_c}{P}\right)$

H_c = Head over crest
P = Weir Height (10')
L_c = 170' (Not incl. spillway)

$$Q_s = 3.9 \times L_s \times H_s^{3/2} \quad \text{(For Ogee type weir)}$$

Where

L_s = Length of Spillway (184')
H_s = Head over spillway crest.

Then $Q_T = Q_c + Q_s$ = Flow over crest plus Flow over spillway

Prepare Stage-discharge table for different values of water Surface elevation. Where: H_s = (water surf. El. − spillway crest elev.) and H_c = (Water Surf. Elev. − Crest Elev.)

DATA

Spillway Elev. : 350.4' MSL
Top of Crest Elev. : 358.4' MSL

Prepare a Curve with the values calculated on table 1 See Fig. 1

HNTB — HOWARD NEEDLES TAMMEN & BERGENDOFF

Made by H.M	Date 10/11/78	Job No. 5523-11-03
Checked by [illegible]	Date 10/26/78	Sheet No. 4

For COY DAM - CLAREMONT, N.H.

NOTE: Flows over the spillway and over the crest are included only

TABLE 1

WATER	Hc	Qc (FLOW OVER CREST)	Hs	Qs (FLOW OVER SPWY.	QT. TOTAL FLOW
350.4	-	0	0	0	
354.4	-	0	4	4,495 ✓	4,495 ✓
358.4	0	0	8	12,710 ✓	12,710 ✓
362.4	4	4,665 ✓	12	23,345 ✓	28,010 ✓
366.4	8	13,810	16	35,940	49,750
370.4	12	26,500	20	50,230	76,730

a) From Fig No. 1 The surcharge height needed to pass Q_{P_1} = 37,800 CFS is 13.93' (Above spillway crest.)

b) Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

$$STOR_1 = \frac{\text{Volume of surcharge storage}}{\text{D. A (S.M.)} \times 640 \text{ Ac/SM}} \times 12"/\text{Ft.} =$$

$$= \left(\frac{62.5 \text{ Acres} \times 13.93'}{270 \text{ S.M.} \times 640 \text{ Ac/SM}} \right) \times 12'/\text{FT} = 0.0605"$$

c). Compute $Q_{P_2} = Q_{P_1} \times \left(1 - \frac{STOR_1}{9.5"}\right)$

$$= 37{,}800 \text{ CFS} \times \left(1 - \frac{0.0605"}{9.5"}\right) = 37{,}560 \text{ CFS} \checkmark$$

STEP 3

a) Determine Surcharge Height and $STOR_2$ To pass Q_{P_2} = 37,560 CFS (From Fig 1 The surcharge height is 13.33" ±) and $STOR_2$:

$$STOR_2 = \left[\frac{62.5\,Ac. \times 13.88'}{270\,SM \times 640\,A/SM}\right] \times 12"/_{FT} = 0.0602"$$

b) Average $STOR_1$ and $STOR_2$

$$STOR_{Avg} = 0.0603"$$

c) Compute $Q_{P_3} = Q_{P_1} \times \left[1 - \frac{STOR_{Avg}}{9.5"}\right] =$

$$= 37{,}800\,CFS \times \left[1 - \frac{0.0603}{9.5"}\right]" =$$

$$= 37{,}560\,CFS$$

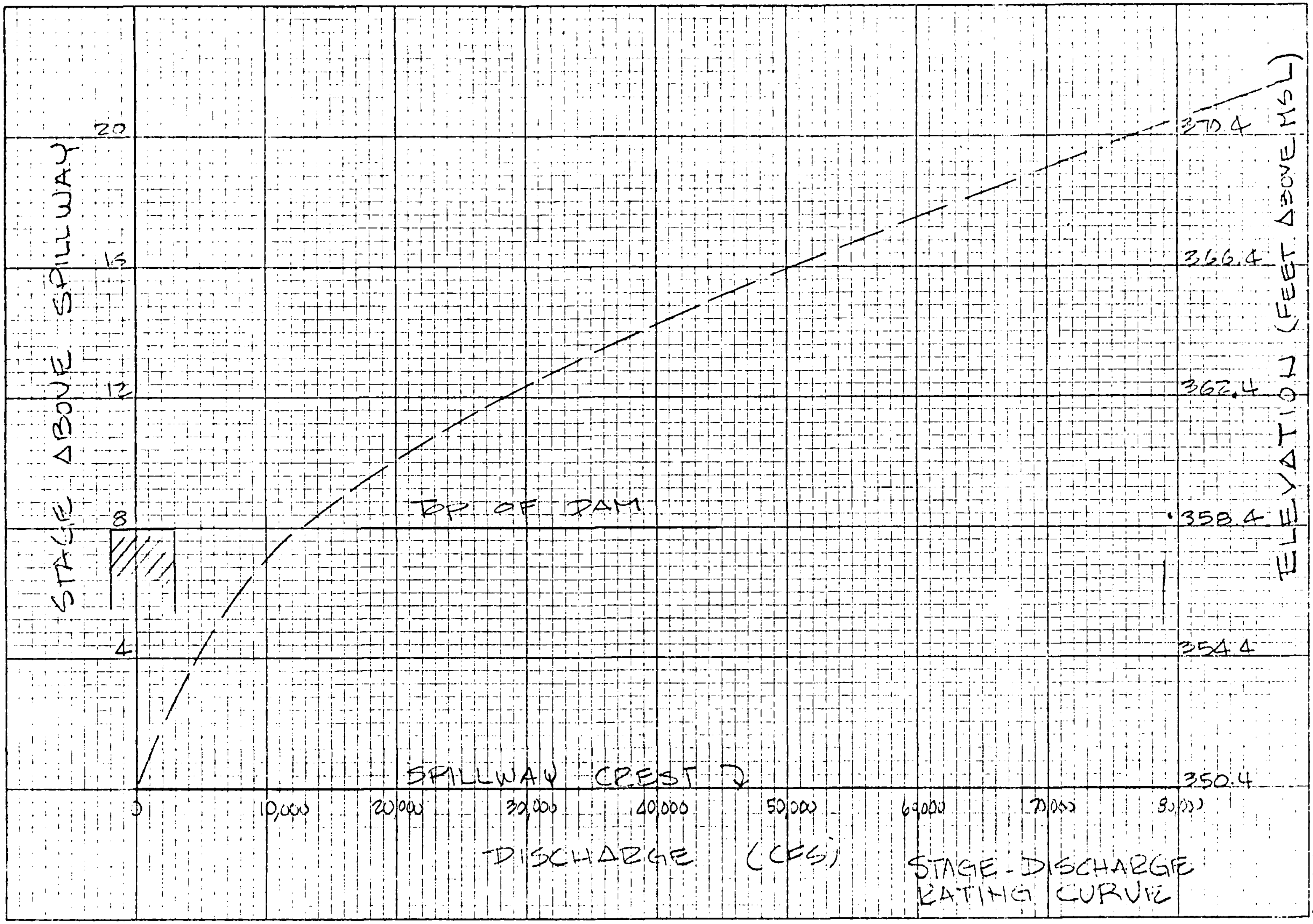
From Fig. 1 For Q = 37,560 CFS the corresponding Elevation is: 364.3'

$$STOR_3 = \left[\frac{625\,Ac \times (364.3' - 350.4')}{270\,SM \times 640\,A/SM}\right] \times 12"/_{FT} = 0.0603"$$ OK!

$\therefore Q_4 = 37{,}560\,CFS$.

CONCLUSIONS:

1. The test Flood discharge will overtop the crest of the dam by approx. 6 Feet.
2. The spillway capacity w/.o overtopping is 12,710 CFS which is the 338% of the Test Flood discharge. (37,560 CFS)
3. No flashboards are assumed to remain when the test flood passes over the spillway.
4. The available discharge thru the gates is approx 940 CFS. completely opened.



STAGE ABOVE SPILLWAY
20
16
12
8
4
TOP OF DAM
370.4
366.4
362.4
358.4
354.4
350.4
ELEVATION (FEET ABOVE MSL)
SPILLWAY CREST
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
DISCHARGE (CFS)
STAGE-DISCHARGE RATING CURVE

FIG II. 1

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Made by HM	Date 10/12/78	Job No 5623-11-03
Checked by PWB	Date 1-12-79	Sheet No 6

For CLAREMONT (COY) DAM.

ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS

Method used was, the "RULE OF THUMB".

STEP 1: ESTIMATE RESERVOIR STORAGE (S) IN A-F AT TIME OF FAILURE:

DATA: (FROM N.H. W.R. Board)

Normal Capacity = 850 A-F (At El. 350.4' MSL)
Maximum Capacity = 1,350 A-F (@ El. 358.4' MSL)

Use S = 1350 Acre-Feet.

—o—

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{P_1})

Formula

$$Q_{P_1} = \frac{8}{27} \times \sqrt{g} \times W_b \times \varphi_o^{3/2}$$

Where:

W_b = Breach width - Value not greater than 40% of Dam Length across river at mid-height (L = 144')

φ_o = 44' (Total height from riverbed to Max. pool elevation, i.e. (El. 358.4' MSL).

$$Q_{P_1} = 1.68 \times 0.4 \times 144 \times (44)^{3/2} = 28{,}242 \text{ CFS.}$$

—o—

SAY Q_{P_1} = 23,240 CFS

STEP 3: PREPARE STAGE-DISCHARGE CURVE FOR SECTION OF REACH No 1 (SEE FIG. 2)

BREACH DATA

L = 1,000' (Length)
S_o = 0.0022 V/H (Bottom Slope)
n = 0.040 (MANNING'S)

CHANNEL DATA

SHAPE = Non-symmetrical Trap.
LEFT BANK SLOPE = 1.5:1
RIGHT BANK SLOPE = 3.12:1
BASE WIDTH = 100'

STEP 4: ESTIMATE REACH OUTFLOW (Q_{P_2}) USING FOLLOWING OPERATION.

A. Apply Q_{P_1} to stage curve on Fig 2, and determine the stage and accompanying Volume (V_1) in the reach.

$Q_{P_1} = 28{,}240$ CFS $\rightarrow$ $d_1 = 15.94'$ (Stage)
$A_1' = 2{,}180^{\#}$ (Area)

$$V_1 = \frac{L' \times A^{\#}}{43560} = \frac{7000 \times 2180}{43560} = 350 \text{ A-F}$$

V_1 does not exceed $S/2 = \frac{1{,}350 AF}{2} = 675$ AF (Length is OK)

$V_1 = 350^{AF} < S/2 = 675$ AF

B. Determine trial $Q_{P_2(Trial)} = Q_{P_1} \times \left(1 - \frac{V_1}{S}\right)$

$$Q_{P_2} = 28{,}240^{CFS} \times \left(1 - \frac{350 AF}{1350 AF}\right) = 20{,}920^{CFS}$$

C. Compute stage and V_2 for Q_{P_2}

$Q_{P_2} = 20{,}920$ CFS $\quad d_2 = 13.50'$ (Stage)
$A_2 = 1770^{\#}$ (Area)

$$V_1 = \frac{7000' \times 1{,}770^{\#}}{43{,}560} = 284 \text{ AF}$$

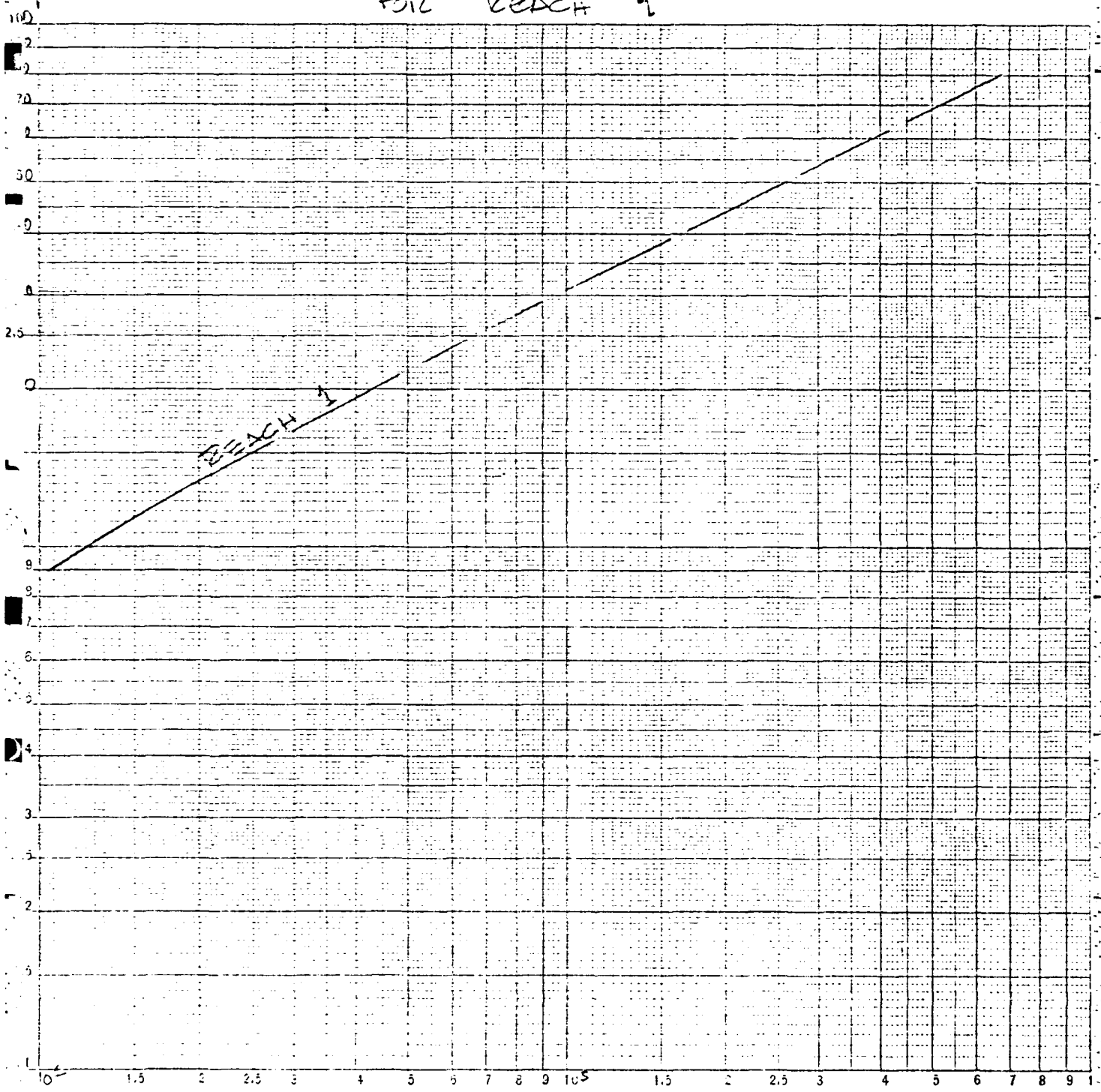
D. Average V_1 & V_2 and compute Q_{P_2}

$$V_{AVG} = \frac{350 AF + 284 AF}{2} = 317 \text{ AF}$$

$$Q_{P_2} = Q_{P_1} \times \left[1 - \frac{V_{AVG}}{S}\right] =$$

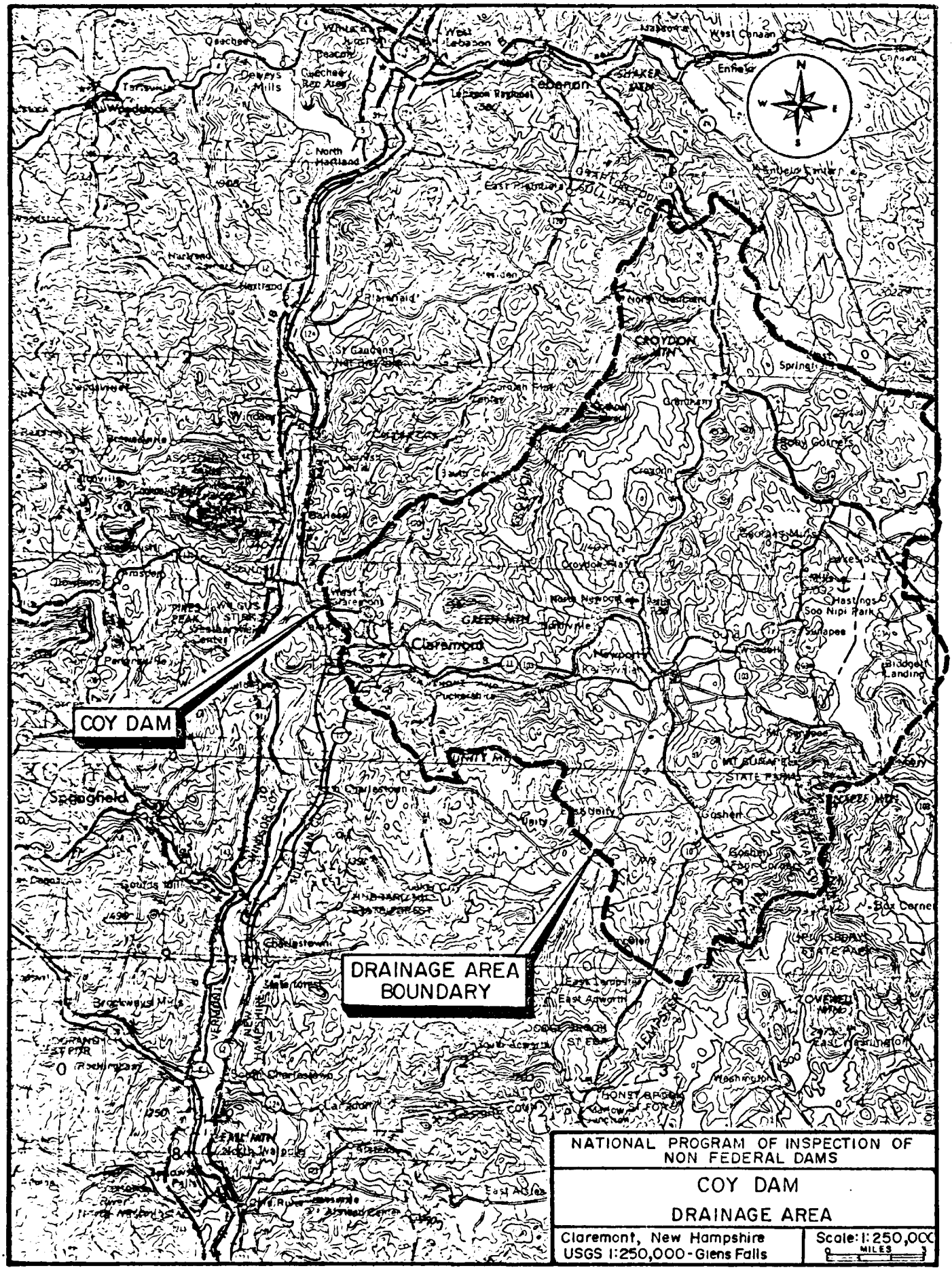
$$= 28{,}240^{CFS} \times \left[1 - \frac{317 AF}{1350 AF}\right] = \underline{21{,}609 \text{ CFS}}$$

SUGAR RIVER CHANNEL
STAGE-DISCHARGE CURVE
FOR REACH #1



DISCHARGE (CFS)

FIG No. 2



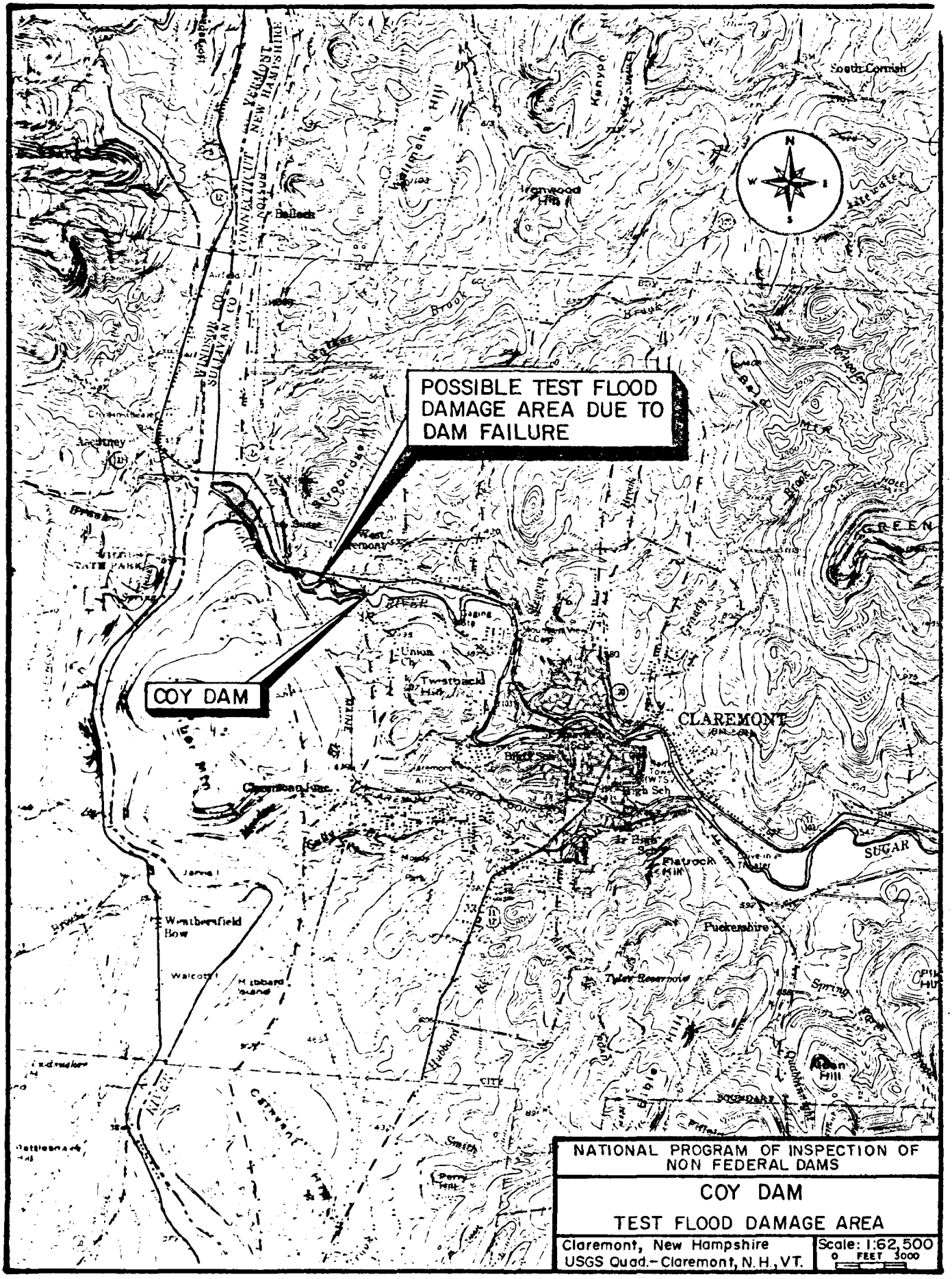
NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

COY DAM

DRAINAGE AREA

Claremont, New Hampshire
USGS 1:250,000-Glens Falls

Scale: 1:250,000
MILES


POSSIBLE TEST FLOOD DAMAGE AREA DUE TO DAM FAILURE
COY DAM
CLAREMONT
N
W
E
S
NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS
COY DAM
TEST FLOOD DAMAGE AREA
Claremont, New Hampshire
USGS Quad.- Claremont, N.H., VT.
Scale: 1:62,500
0 FEET 3000

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
NH	140	NED	NH	019	02				COY DAM	4325.4	7222.6	270CT78

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
COY DAM	SUGAR RIVER

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	08	SUGAR RIVER	CLAREMONT	0	14221

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
RECTPG	1923	HS	44	44	1350	850	NED	N	N	N	N	4DEC78

(28) REMARKS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
2	314	U	144	12710		4.0										

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
COY PAPER CO	COY PAPER CO	FISK-CARTER COMPANY

(49) REGULATORY AGENCY DESIGN	(50) CONSTRUCTION	(51) OPERATION	(52) MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NH WATER RES BD

(53) INSPECTION BY	(54) INSPECTION DATE DAY | MO | YR	(55) AUTHORITY FOR INSPECTION
HOWARD NEEDLES TAMMEN + BERGENDRF	10APR73	

(56) REMARKS

END

FILMED

8-85

DTIC